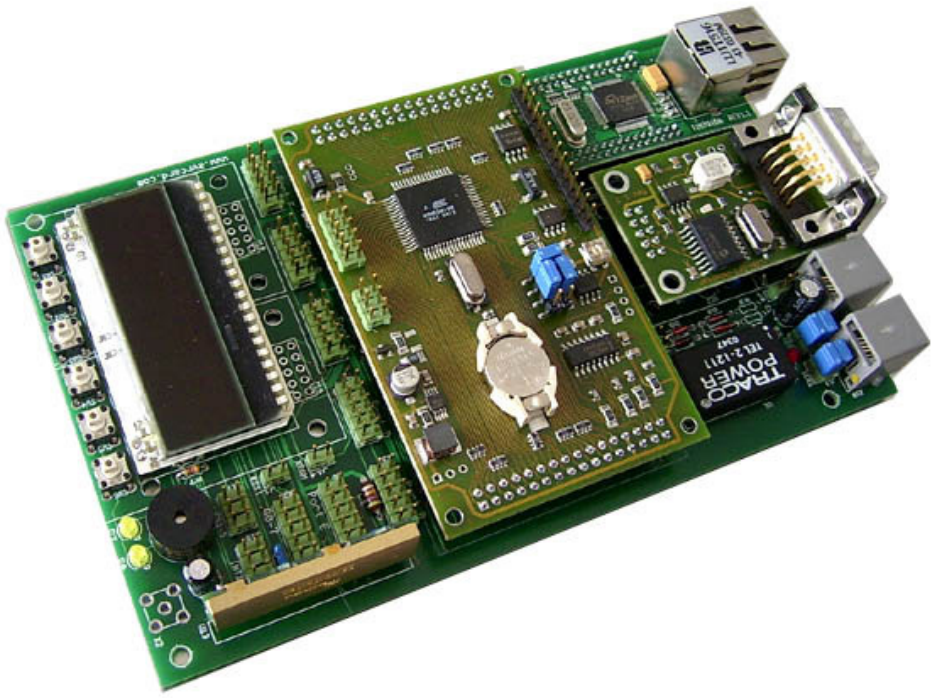

AVR Playground

User Manual

Board Rev.:	2.1
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www.avrcard.com

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Revision History

The revision history is shown in Section References on page 27

Web Site

This manual can also be found on the website www.avrcard.com.

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Section 1
About the Playground Board

The AVR Playground is a base board for the AVRcard Microcontroller Core Module. It provides easy connection options, and a number of additional features.

Application

- Development platform for AVR (ATmega128) based solutions
- Education platform
- Platform for functional prototypes

Main Features

- Plug-in AVRcard with Atmega128 processor
- Plug-in expansion modules on I2C and SPI bus
- Plug-in EasyRadio RF transceiver module
- Plug-in Class 1 Bluetooth module
- Plug-in 16x3 character LCD on SPI bus
- 6 pushbuttons on I2C port expander
- Piezo speaker
- Voltage regulator, allows for use of inexpensive power supply
- Standard RJ-45 connectors for both RS-232 and the RS-485 interfaces
- CPU ports routed to headers with STK500 compatible pinout
- Address bus demultiplexed
- 32Kbytes SRAM
- Euro card size (100 x 160mm)

Additional Resources

- Product Information – All updated product information can be retrieved at the product web site, www.avrcard.com.
- Application Support – Please check the Resources pages regularly at www.avrcard.com for design notes and application hints. Further support is available by email from support@avrcard.com.
- Custom Designs – Custom population or customized versions of the product are available. For inquiries please contact info@avrcard.com.

Section 2
Getting started

Your First Steps

Prerequisites for Operation

The following hardware items are necessary to run the Playground board:

- A standard PC equipped with Linux or Windows 95/98/NT/2000 and an available serial COM port.
- Terminal emulation software, such as Hyperterminal.
- An unregulated power supply matching your local mains. It should supply DC 8-16V, 200 mA minimum, on a a EIAJ Standard JSAP3 connector.

Installation

Remove the board from the antistatic bag. Visually inspect the board to verify that it was not damaged during shipment.

WARNING: *As with all computer equipment, the Playground board may be severely damaged by electrostatic discharge (ESD). Be sure to take proper precautions before removing the Playground board from the anti-static bag.*

1. Set jumpers according to the application's requirement. Refer to Board Configuration on page 11 for details.
2. If you purchased the Playground separately from the AVRcard core module, insert the AVRcard. See instructions on page 12.
3. If you want to add on-board options, please refer to Section Onboard Options from page 14 in this manual.
4. If you want to add expansion modules, please refer to Section Expansion Modules from page 17 in this manual and to the respective module datasheet.
5. Connect serial cable on X10 (Serial port 1) and to an available COM port on the PC. Start a terminal program, use the communications parameters:

   ```
   9600bps, 8 databits, 1 stopbit, no parity, no handshake.
   ```

6. Connect the power cable to a DC power supply of 9-12V.

Operation

1. Switch on power. The red LED D1 will lit.
2. On the terminal appears the welcome message of the AVRcard monitor. Refer to [1] for a description of the available monitor commands and features.

Section 3
Hardware Description

Functional Block Diagram

Figure 1 – Functional Block Diagram

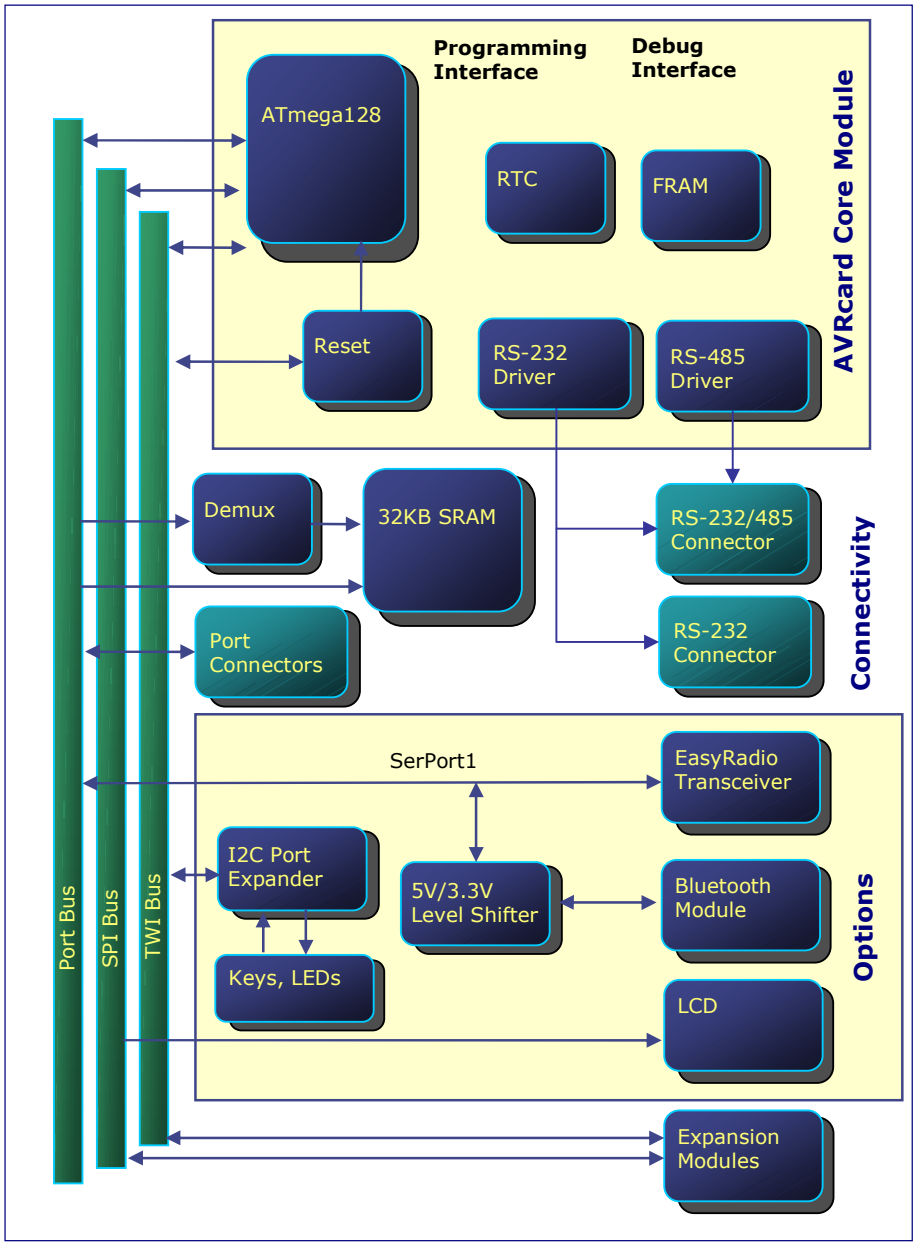
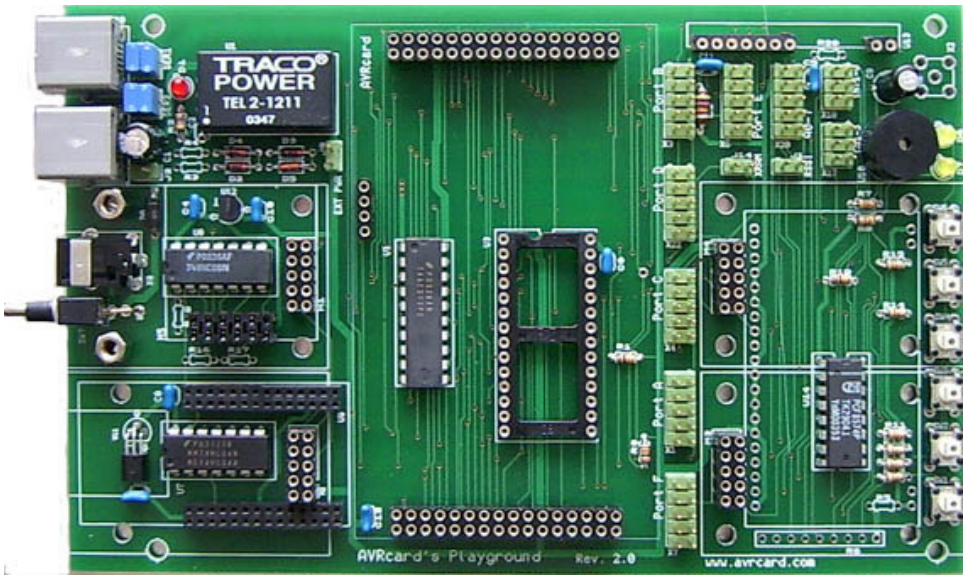


Figure 2 shows the baseboard and its different functional areas. These areas are detailed in the following sections.

Figure 2 – Hardware Layout and Placement



AVRcard slot Two 32-pin headers connect to power and ports. A 1-pin header connects to the CPU reset signal, as there is no reset signal on the standard connectors of the AVRcard. The reset signal is used in conjunction with the TCP/IP module and the expansion modules.

TCP/IP Module This slot receives the IIM7010 Ethernet module.

RS-232 connectors Two RJ-45 connectors are provided for easy connection to the two RS-232 interfaces of the AVRcard. Pin assignment of each connector can be configured by jumpers (J13, J15).

The second RJ-45 connector also carries the RS-485 signals and the DC input voltage of the board. This voltage is enabled by Jumper J2 and can be used to remotely power RS-485 nodes.

Power supply A standard 7805 voltage regulator is provided for the 5V supply. Alternatively, a 2 Watt DC-DC converter can be used to provide an increased DC input voltage range (e.g. 9-18V, 18-36V). DC power is applied through the power jack J8. A diode protects the circuit against false polarity.

For the Ethernet-Module, a separate 3.3V regulator is used. A second 3.3V regulator is used for the Bluetooth module.

Reset The Reset signal is routed from the AVRcard core module to the Playground baseboard via a one-pin header that connects to the bottom of the ISP header on the AVRcard. For the IIM7010A Ethernet adapter, the reset signal is also inverted by U11 (74HC04). The active low reset is distributed to all expansion modules and the Bluetooth module.

External SRAM The Playground contains a footprint for a 28-pin DIP socket (U3) where an external SRAM device can be mounted. Make sure the SRAM device has the same voltage range as the rest of the design.

Onboard options

LCD and Pushbutton keys A small alphanumeric LCD (3 lines, 16 characters) can be mounted across the lower expansion module area (J25). The connector pinout is designed for the EA DOG-M module from Electronic Assembly. It is connected to the SPI bus.

A PCF8574 I2C port expander allows for the connection of 6 pushbuttons and 2 LEDs.

Please refer to chapter "LCD Module and Keys" on page 14 for further details on this option.

EasyRadio RF module

An EasyRadio RF transceiver module can be connected to serial port 1. An antenna connector is also provided on the Playground board.

Please refer to chapter "EasyRadio RF Transceiver Module" on page 15 for further details on this option.

Bluetooth Module

A class 1 bluetooth module with a serial channel profile can be connected to serial port 1.

Please refer to chapter "Bluetooth Module" on page 16 for further details on this option.

Expansion modules

The AVR Playground provides 4 slots for additional minimodules. These small form-factor modules connect via the TWI or the SPI interface and provide specific connectivity and i/o functions.

For more details, refer to Section "Expansion Modules" on page 17.

Header Connectors

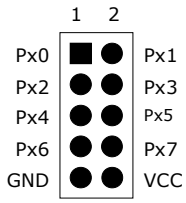
All CPU ports and some additional signals can be connected by standard 0.1" headers. Pin 1 of each header has a square pad.

Figure 3 – Pin 1 Position on I/O Port Headers

Port Connectors

The pinout for the I/O port headers is explained in Figure 4. It is compatible to Atmel's STK500 port headers.

Figure 4 - General Pinout of I/O Port Headers

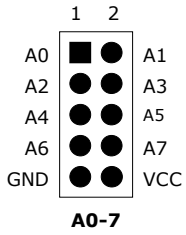


PORTx

A0-7 Connector

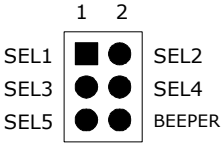
The connector X20, marked A0-7 contains the 8 least-significant bits of the external address bus. The purpose of the connector is to provide easy access to the address bus. The 8 most significant bits can be found on the Port C connector X4.

Figure 5 – A0-7 Connector Pinout



Expansion module select signals

Figure 6 – Expansion modules select signals

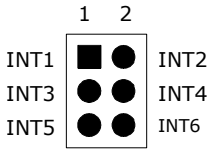


SEL5 is connected to the CS signal of the on-board LCD.

BEEPER is connected to the on-board piezo speaker. This speaker can be connected to any port to deliver audible signals.

Expansion module interrupt signals

Figure 7 – Expansion modules interrupt signals



INT5 is connected to the INT signal of the Ethernet module.

INT6 is connected to the INT signal of the on-board I2C port expander used for the pushbutton switches.

Section 4
Board Configuration

Jumper Settings

Figure 8 – Jumper locations

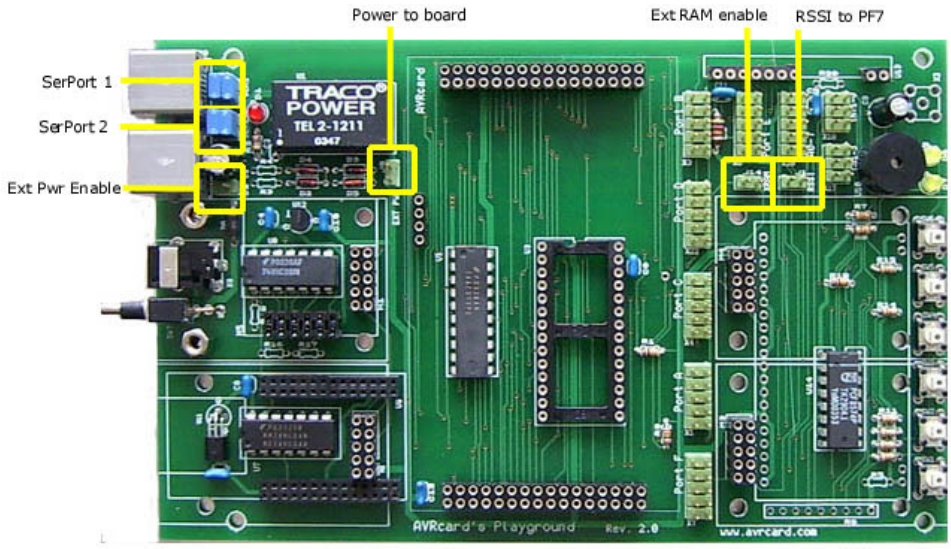
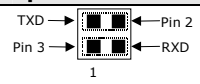
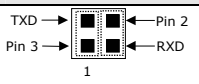


Table 1 - Jumper Settings

No.	Description	Status	
		open	**short**
J13 J15	SerPort1 SerPort2	 For straight serial cable	 For crossover serial cable
J2	Ext Pwr	No power on pin 1 of X11	DC input power on pin 1 of X11
J9	Pwr	Board not powered by on-board voltage regulator	+5V power applied to board
J1	RSSI	RSSI Output of EasyRadio module connected to ADC7	N.C.
J14	XRAM	CS of SRAM connected to A15 [1]	CS of SRAM pulled high

The RXD and TXD signals can be interchanged on each of the RJ45 connectors, as shown in the table.

Jumpers are standard (0.1").

Note: *The SRAM is disabled by default. To enable SRAM support, put a jumper on J14. The SRAM occupies the memory space from $1000-$7FFF.*

[1] Please note that on the AVRcard core module, A15 (PC7) is also used as an enable signal for the RS-485 driver.

AVRcard Core Module

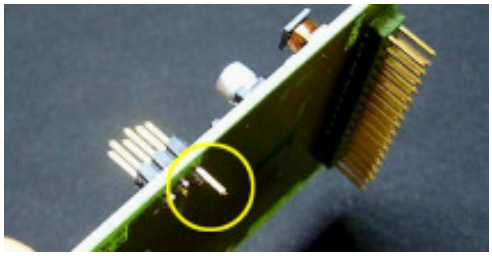
To fit the AVRcard core module, you must solder the following 0.1” headers face down to the AVRcard:

Table 2 – AVRcard Connectors

Connector	Pin count	Fits to	Description
X4	32	U4	CPU ports
X5	32	U4	CPU ports, RS-232
X7	4	U4	RS-485

The Reset signal is taken from the ISP header (X2, pin 5). The pin is pushed a few millimeters to the bottom of the board.

Figure 9 – Reset pin



DC Power Supply

The complete logic of the Playground board is driven by a single 5V power supply. It can be powered from the following sources:

- Battery with 2…5V
- External DC power, using a linear voltage regulator
- External DC power, using a switching voltage regulator.

Battery Operation

The battery is connected to X1 on the AVRcard. As shown in Table 3. The on-board power switch is inactive in this configuration.

The step-up DC converter on the AVRcard is capable of delivering 250mA at 5V. Please refer to [1].

***Note**: Make sure the jumper J9 is be left open in this configuration.*

Table 3 – Battery Connector Pinout

Pin	Function	Description
1	BATT+	+2..5V battery power input
2	BATT-	0V battery (GND)
3	/LOWBATT	is pulled low if battery voltage drops below 1.3V

External Power, Linear Regulator

In this (default) configuration, an 7805 regulator is used to supply the 5V to the board. It is fitted with a 15K/W heatsink.

Power shall be applied through a EIAJ Standard JSAP3 plug to X8:

Table 4 – External Power Connector Pinout (X8)

Pin	Function
inner	PWR -
outer	PWR +

The jumper J9 must be closed in order to route 5V supply to the board.

External Power, Switching Regulator

As an option, a 2 Watt DC-DC converter can be soldered in place of the linear regulator. With this, a wider input voltage range can be achieved. A datasheet of a suitable DC converter can be found in [7].

Power shall be applied through a EIAJ Standard JSAP3 plug to X8, as shown above.

The jumper J9 must be closed in order to route 5V supply to the board.

Section 5
Onboard Options

LCD Module and Keys

Figure 10 – LCD and keys option

This option comprises the following components:

- LCD module (U6)
- PCF8574 I2C port expander (U14)
- 6 pushbuttons SW1-6
- 2 LEDs, R7, R8
- R5, R6, R10-15, R19

The LCD is connected to the SPI bus. In addition to the MOSI and SCK lines, it uses PB4 for the Register Select (RS) signal. Please refer to [6] for details on the operation of the LCD. The select (CS5) must be jumpered to an available CPU port.

Display contrast is adjusted by software. R4 sets the background LED current.

The pushbutton switches can be read via the I2C port expander, they are active low. Alternatively, LEDs can be used in place of a switch, as the PCF8574 is able to source 20mA on each output. Refer to the PCF8574 datasheet in [4].

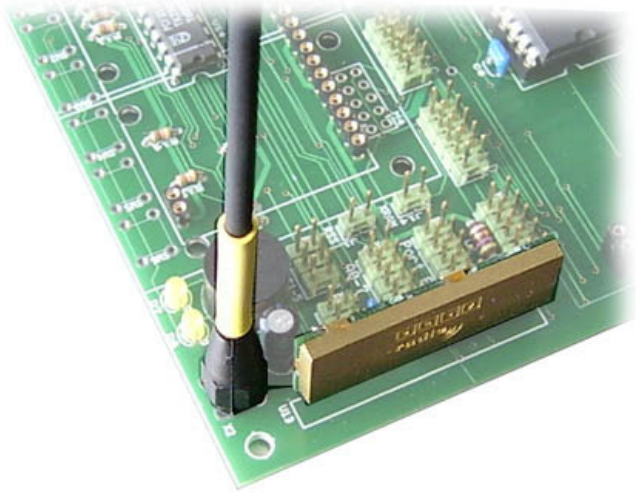
The PCF8574 provides an interrupt line which is routed to INT6 (X18). This line is pulled low on each level change on the input ports.

Table 5 – Port signals used for LCD module

Port	Function	I/O	Comments
PB1	SCK	O	
PB2	MOSI	O	
PB4	RS	O	

EasyRadio RF Transceiver Module

Figure 11 – EasyRadio option

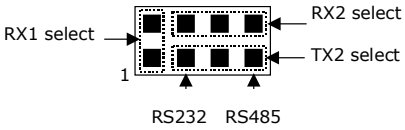


This option comprises:

- ER-TRS transceiver module
- SMA antenna connector
- Antenna
- L1, C11, C12, R20

Detailed information on the transceiver module can be found in [7].

***Note**: To operate the EasyRadio module, the serial port jumper RX1 select on the AVRcard must be removed:*



***Note**: Either the EasyRadio or the Bluetooth module may be used at the same time, as they share the serial port 1. The RS-232 interface is disabled when this option is used.*

Table 6 – Port signals used for EasyRadio module

Port	Function	I/O	Comments
PD4	RTS	O	
PD5	CTS	I	
PE0	TXD	I	Via R20
PE1	RXD	O	
PF7	RSSI	I	Via jumper J1

Bluetooth Module

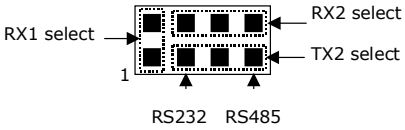
Figure 12 – Bluetooth option

The Promi-ESD class 1 Bluetooth module [8] is connected to serial port 1 and additional control lines through a 3V/5V level converter (74VHC08, U8).

This option comprises:

- Promi-ESD class 1 Bluetooth module
- 3.3V voltage regulator U12 with C4, C10
- Level converter U8, R16, R17, R18
- 10-pin female header M5

***Note**: To operate the Bluetooth module, the serial port jumper RX1 select on the AVRcard must be removed:*



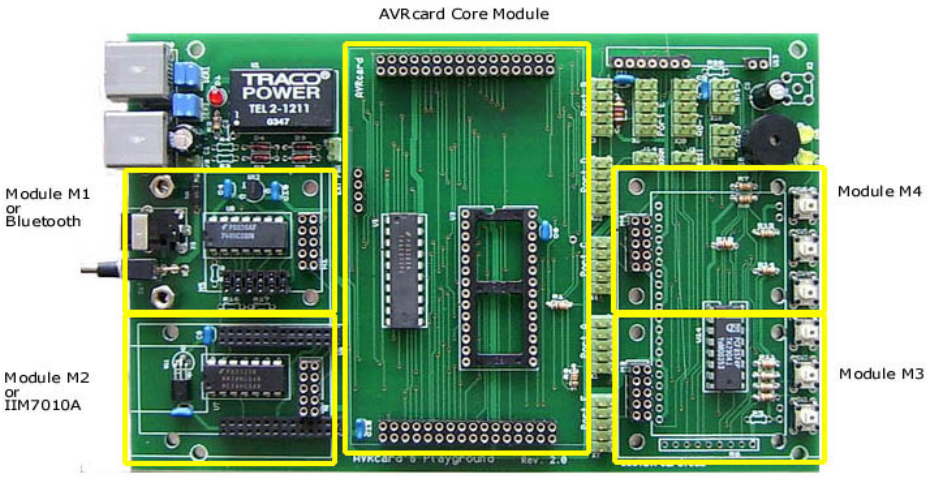
***Note**: Either the EasyRadio or the Bluetooth module may be used at the same time, as they share the serial port 1. The RS-232 interface is disabled when this option is used.*

Table 7 – Port signals used for Bluetooth module

Port	Function	I/O	Comments
PD4	CTS	O	
PD5	RTS	I	
PD6	DCD	I	
PD7	DSR	O	
PE0	TXD	I	Via R18
PE1	RXD	O	

Section 6
Expansion Modules

Figure 13 – Expansion Modules Locations



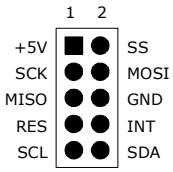
Host Interface

Two serial interfaces are supported by the modules: SPI and I2C. For modules with an onboard AVR controller, the SPI is also used as a programming interface for the firmware.

Pinout of the Host Interface Header

The host controller is connected via an 10-pin header with 0.1” spacing.

Figure 14 – Expansion module connector pinout



I2C Interface

SCL (Pin 9):

Serial Clock line – the signal used to synchronize communication between the master and the slave.

SDA (Pin 10):

Serial Data line – the signal used to transfer data between the transmitter and the receiver.

Pull-up Resistors

There is a 2.7K resistor on each I2C line (SCL, SDA). The lines are effectively pulled up to 5V, so that results in approximately 1.8 mA of pull-up current. If the Playground is connected to an I2C bus that also includes pull-up resisters, the total pull-up current could be up to a total of 3 mA. (The I2C specification allows for a

maximum of 3 mA pull-up current on each I2C line.) As long as downstream I2C devices can sink more than 5 mA of current, the protocol should operate properly.

SPI Interface

SCK (Pin 3):

Serial Clock – control line that is driven by the master and regulates the flow of the data bits.

MOSI (Pin 4):

Master Out Slave In – this data line supplies output data from the master which is shifted into the slave.

MISO (Pin 5):

Master In Slave Out – this data line supplies the output data from the slave to the input of the master.

SS (Pin 2):

Slave Select – control line that allows slaves to be turned on and off via hardware control.

When the SPI interface is activated as a master, the slave select line (SS) will actively driven low by the appropriate firmware driver. The MOSI and SCK lines are driven as appropriate for the SPI mode. After the master transmission is complete, these lines shall be returned to a high impedance state in order for the Playground to be then reconnected to another SPI environment as a slave.

Consequently, any SPI slave target to which the Playground is interfaced must have a pull-up resistor on its slave select line, preventing fluttering of the voltage when the Playground stops driving the signal.

It is also advisable that every slave also have passive pull-ups on the MOSI and SCK lines. These pull-up resistors can be relatively weak – 100k should be adequate. As a slave, the MOSI, SCK, and SS lines are configured as an input and the MISO line is configured as an output.

Control Lines

RES (Pin 7)

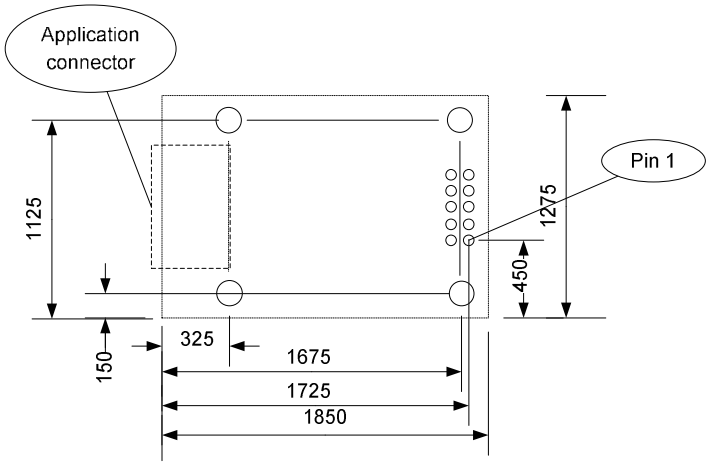
On the Playground, this pin is connected to the CPU reset line, which is a push-pull output. Consequently, the reset line of all modules are activated at the same time on power-up or manual reset.

INT (Pin 8)

This pin is routed to X18, from where it can be jumpered to one of the external interrupt inputs of the ATmega128 (INT4-7 on X6).

Mechanical Data

Figure 15 – Mechanical dimensions of expansion modules



- Dimensions: mil
- Mounting holes 3.2mm diameter
- Mounting holes on application connector side are connected to ground of module.
- Mounting holes on host interface side are isolated
- Top view (components side)

Section 7
Serial Busses

I2C

History

When connecting multiple devices to a microcontroller, the address and data lines of each devices were conventionally connected individually. This would take up precious pins on the microcontroller, result in a lot of traces on the PCB, and require more components to connect everything together. This made these systems expensive to produce and susceptible to interference and noise.

To solve this problem, Philips developed Inter-IC bus, or I2C, in the 1980s. I2C is a low-bandwidth, short distance protocol for on board communications. All devices are connected through two wires: serial data (SDA) and serial clock (SCL).

Because all commnication takes place on only two wires, all devices must have a unique address to identify it on the bus. Slave devices have a predefined address, but the lower bits of the address can be assigned to allow for multiples of the same devices on the bus.

Theory of Operation

I2C has a master/slave protocol. The master initiates the communication. The sequence of events are:

1. The master device issues a start condition. This condition informs all the slave devices to listen on the serial data line for their respective address.
2. The master device sends the address of the target slave device and a read/write flag.
3. The slave device with the matching address responds with an acknowledgment signal.
4. Communication proceeds between the master and the slave on the data bus. Both the master and slave can receive or transmit data depending on whether the communication is a read or write. The transmitter sends 8-bits of data to the receiver which replies with a 1-bit acknowledgment.
5. When the communication is complete, the master issues a stop condition indicating that everything is done.

Regardless of how many slave units are attached to the I2C bus, there are only two signals connected to all of them. Consequently, there is additional overhead because an addressing mechanism is required for the master device to communicate with a specific slave device.

Features

I2C has many features other important features worth mentioning. It supports multiple data speeds: standard (100 kbps), fast (400 kbps) and high speed (3.4 Mbps) communications.

Other features include:

- Built in collision detection,
- 10-bit Addressing,
- Multi-master support,
- Data broadcast (general call).

For more information about other features, look at the references at the end of this section.

Benefits and Drawbacks

Since only two wires are required, I2C is well suited for boards with many devices connected on the bus. This helps reduce the cost and complexity of the circuit as additional devices are added to the system.

Due to the presence of only two wires, there is additional complexity in handling the overhead of addressing and acknowledgments.

I2C Slave Adresses

The following devices are connected to the TWI bus. The Atmega128 is configured as master, the other devices are slaves.

Note that the addresses below contain the R/W bit.

Slave address assignments

Table 8 – I2C addresses

Address	Device	Function	Ref. [2]
0x50	FeRAM	Nonvolatile RAM, on AVRcard	
0x68	RTC	Realtime clock, on AVRcard	
0x21	Port expander	Pushbutton keys, LEDs	U14
0x7F	IIM7010A Module	TCP/IP over Ethernet connectivity	U9

SPI

History

SPI is a serial communication bus developed by Motorola. It is a full-duplex protocol which functions on a master-slave paradigm that is ideally suited to data streaming applications.

Theory of Operation

SPI requires four signals: clock (SCLK), master output/slave input (MOSI), master input/slave output (MISO), slave select (SS). Three signals are shared by all devices on the SPI bus: SCLK, MOSI and MISO. SCLK is generated by the master device and is used for synchronization. MOSI and MISO are the data lines. The direction of transfer is indicated by their names. Data is always transferred in both directions in SPI, but an SPI device interested in only transmitting data can choose to ignore the receive bytes. Likewise, a device only interested in the incoming bytes can transmit dummy bytes.

Each device has its own SS line. The master pulls low on a slave's SS line to select a device for communication. The exchange itself has no pre-defined protocol. This makes it ideal for data-streaming applications. Data can be transferred at high speed, often into the range of the tens of megahertz. The flipside is that there is no acknowledgment, no flow control, and the master may not even be aware of the slave's presence.

Modes

Although there is no protocol, the master and slave need to agree about the data frame for the exchange. The data frame is described by two parameters: clock polarity (CPOL) and clock phase (CPHA). Both parameters have two states which results in four possible combinations. These combinations are shown in the above table.

Benefits and Drawbacks

SPI is a very simple communication protocol. It does not have a specific high-level protocol which means that there is almost no overhead. Data can be shifted at very high rates in full duplex. This makes it very simple and efficient in a single master single slave scenario. Because each slave needs its own SS, the number of traces required is n+3, where n is the number of SPI devices. This means increased board complexity when the number of slaves is increased.

[2] Part reference designator, see schematic diagram in section Circuit Diagrams on page 22.

Section 8
Circuit Diagrams

The diagrams on the following pages are also availabe in a separate document.

Section 9
Connectors Pinout Summary

CPU Ports

X1

Table 9 – Port A Connector Pinout

Pin	Function	Alt. Function	I/O	Internal Connections	
				Playground	AVRcard
1	PA0	AD0	I/O	U3/D0, U2/1D	
2	PA1	AD1	I/O	U3/D1, U2/2D	
3	PA2	AD2	I/O	U3/D2, U2/3D	
4	PA3	AD3	I/O	U3/D3, U2/4D	
5	PA4	AD4	I/O	U3/D4, U2/5D	
6	PA5	AD5	I/O	U3/D5, U2/6D	
7	PA6	AD6	I/O	U3/D6, U2/7D	
8	PA7	AD7	I/O	U3/D7, U2/8D	
9	GND		PWR		
10	VCC		PWR		

X3

Table 10 – Port B Connector Pinout

Pin	Function	Alt. Function	I/O	Internal Connections	
				Playground	AVRcard
1	PB0	SS	I/O		
2	PB1	SCK	I/O	U6/D6, M1, M2, M3, M4	X2/3
3	PB2	MOSI	I/O	U6/D7, M1, M2, M3, M4	
4	PB3	MISO	I/O	M1, M2, M3, M4	
5	PB4	OC0	I/O	U6/RS	
6	PB5	OC1A	I/O		
7	PB6	OC1B	I/O		
8	PB7	OC2	I/O		
9	GND		PWR		
10	VCC		PWR		

X4

Table 11 – Port C Connector Pinout

Pin	Function	Alt. Function	I/O	Internal Connections	
				Playground	AVRcard
1	PC0	A8	I/O	U3/A8	X6/11
2	PC1	A9	I/O	U3/A9	X6/12
3	PC2	A10	I/O	U3/A10	X6/13
4	PC3	A11	I/O	U3/A11	X6/14
5	PC4	A12	I/O	U3/A12	X6/6
6	PC5	A13	I/O	U3/A13	X6/4
7	PC6	A14	I/O	U3/A14	X6/5
8	PC7	A15	I/O	U3/CS via J4	RS-485 EN
9	GND		PWR		
10	VCC		PWR		

X22

Table 12 – Port D Connector Pinout

Pin	Function	Alt. Function	I/O	Internal Connections	
				Playground	**AVRcard**
1	PD0	INT0/SCL	I/O	U9/SCL, U14/SCL	FRAM, RTC
2	PD1	INT1/SDA	I/O	U9/SDA, U14/SDA	FRAM, RTC
3	PD2	INT2/RXD1	I/O		RS-232, RS-485
4	PD3	INT3/TXD1	I/O		RS-232, RS-485
5	PD4	IC1	I/O	M5/CTS, U13/RTS	
6	PD5	XCK1	I/O	M5/RTS, U13/CTS	
7	PD6	T1	I/O	M5/DCD	
8	PD7	T2	I/O	M5/DSR	
9	GND		PWR		
10	VCC		PWR		

X6

Table 13 – Port E Connector Pinout

Pin	Function	Alt. Function	I/O	Internal Connections	
				Playground	**AVRcard**
1	PE0	RXD	I/O	M5/TXD, U13/RXD	X2/4, RS-232
2	PE1	TXD	I/O	M5/RXD, U14/TXD	X2/1, RS-232
3	PE2	AC+	I/O		
4	PE3	AC-	I/O		
5	PE4	INT4	I/O		
6	PE5	INT5	I/O		
7	PE6	INT6	I/O		
8	PE7	INT7	I/O		
9	GND		PWR		
10	VCC		PWR		

X7

Table 14 – Port F Connector Pinout

Pin	Function	Alt. Function	I/O	Internal Connections	
				Playground	**AVRcard**
1	PF0	ADC0	I/O		
2	PF1	ADC1	I/O		
3	PF2	ADC2	I/O		
4	PF3	ADC3	I/O		
5	PF4	ADC4/TCK	I/O		X3/3
6	PF5	ADC5/TMS	I/O		X3/1
7	PF6	ADC6/TDO	I/O		X3/7
8	PF7	ADC7/TDI	I/O	U13/RSSI via J1	X3/4
9	GND		PWR		
10	VCC		PWR		

Address Lines

X20

Table 15 – A0-7 Connector Pinout

Pin	Function	Alt. Function	I/O	Internal Connections
1	A0		I/O	U3/A0, U2/1Q
2	A1		I/O	U3/A1, U2/2Q
3	A2		I/O	U3/A2, U2/3Q
4	A3		I/O	U3/A3, U2/4Q
5	A4		I/O	U3/A4, U2/5Q
6	A5		I/O	U3/A5, U2/6Q
7	A6		I/O	U3/A6, U2/7Q
8	A7		I/O	U3/A7, U2/8Q
9	GND		PWR	
10	VCC		PWR	

Expansion Modules

The Slave Select (SS) signals of the expansion modules are routed to X17:

Table 16 – SPI Select Lines (X17)

No.	Function
1	CS Module 1
2	CS Module 2
3	CS Module 3
4	CS Module 4
5	CS LCD Module
6	Beeper

Interrupt outputs of expansion modules are routed to X18:

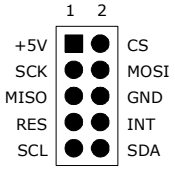
Table 17 – Interrupt Lines (X18)

No.	Function
1	INT Module 1
2	INT Module 2
3	INT Module 3
4	INT Module 4
5	INT IIM7010A
6	INT PCF8574 (Keyboard)

Table 18 – Expansion Module Connectors

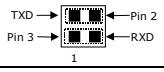
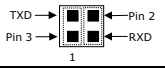
No.	Function	Alt. Function
M1	General	Promi-ESD Bluetooth-to-serial adapter (M5)
M2	General	IIM7010A, TCP/IP over Ethernet (U9)
M3	General	16x3 LCD Module (U6)
M4	General	

Figure 16 – Expansion module connector pinout



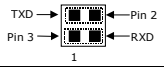
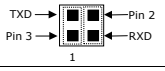
Serial Ports

Table 19 – Serial Port 1 Connector Pinout (X10)

Pin	Function	Alt. Function	Level
1	(N.C.)		
2	TXD	RXD	RS-232
3	RXD	TXD	RS-232
4	(N.C.)		
5	GND		
6	(N.C.)		
			

Pin functions are selected by jumpers J13.

Table 20 – Serial Port 2 Connector Pinout (X11)

Pin	Function	Alt. Function	Level
1	+Vin (activated by J2)		
2	TXD	RXD	RS-232
3	RXD	TXD	RS-232
4	B		RS-485
5	GND		
6	A		RS-485
			

Pin functions are selected by jumpers J15.

***Note**: Either RS-232 or RS-485 is available on this port, according to jumper setting on the AVRcard core module.*

DC Power

Table 21 – DC Power Connector Pinout (X8)

Pin	Function
inner	PWR -
outer	PWR +

Plug type: EIAJ Standard JSAP3

Section 10
References

Product References

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Other References

[10] *I2C-bus* – Philips Semiconductors Official I2C website (http://www.semiconductors.philips.com/buses/i2c/)

[11] *I2C* – Open Directory Project Listing (http://dmoz.org/Computers/Hardware/Buses/I2C/)

[12] *SPI - Serial Peripheral Interface* (http://www.mct.net/faq/spi.html)

Revision History

Rev. 2.1, Date: 01.06.2005

Initial Revision for Rev. 2 Playground

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Section 11
Notice to Users

AVRcard products are not authorized for use as critical components in life-support devices or systems.

Life-support devices or systems are devices or systems intended for surgical implantation into the body or to sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling and user's manual, can be reasonably expected to result in significant injury.

No complex software or hardware system is perfect. Bugs are always present in a system of any size. In order to prevent danger to life or property, it is the responsibility of the system designer to incorporate redundant protective mechanisms appropriate to the risk involved.

All AVRcard products are 100 percent functionally tested. Additional testing may include visual quality control inspections. Specifications are based on characterization of tested sample units rather than testing over temperature and voltage of each unit. AVRcard products may qualify components to operate within a range of parameters that is different from the manufacturer's recommended range.